

Remarks/Arguments

Claims 1-4, 6, 8-16, 27-28, 31-34, 36, and 38-49 are now active in this application, claims 5, 7, 17-26, 29-30, 35 and 37 having been cancelled by the present amendment. Claims 1 and 31 have been amended to insert the limitations of claims 5 and 7 (into Claim 1) and claims 35 and 37 (into Claim 31). Additionally each of these claims has been amended to require that each of the external facets of the crystal be of substantially equal size. This amendment is supported by the Figures as originally filed and the specification at page 8, lines 16-20. The amendments to the remaining claims are to merely correct dependencies, due to cancellation of claims 7 and 37. Claims 38 and 48 (indicated as allowable subject matter) have been rewritten as independent claims incorporating the limitations of original claim 31 from which they depended. No new matter is believed to be added by the amendments.

Applicants representative would like to thank Examiners Lish and Hendrickson for the courteous and helpful discussion of the issues in the present application on October 21, 2003. Applicants would like to thank the Examiners for the indication of allowable subject matter in original claims 12-14, 29-30, 38, 42-44 and 48 and the indication that the claims as now amended appear to overcome the art of record.

The present invention relates to new graphitic polyhedral crystals having unique properties and comprising graphite sheets arranged in a plurality of layers to form an elongated structure having a long axis and a diameter and having 7 or more external facets running substantially the length of the long axis, wherein preferred embodiments have a diameter of from 5nm to 1000nm and the external facets being of substantially equal size, and wherein preferred embodiments have the crystals being in a form selected from needles, giant nanotubes, rings, cones, double tipped pyramids, nanorods and whiskers. In other independent claims of the present invention, the present invention also includes reinforced

matrix composites comprising a matrix reinforced with the graphitic polyhedral crystals comprising graphite sheets arranged in a plurality of layers to form an elongated structure having a long axis and a diameter and having 7 or more external facets running substantially the length of the long axis, wherein the external facets run axially true, or wherein the matrix is a metal.

As discussed in the specification and during the discussion between Applicants' representative and the Examiners, prior to Applicants discovery, the only reported graphitic polyhedral crystals had up to 5 or 6 sides only and were typically generated by the use of high temperature processes such as arc discharge. As shown in the present specification, Applicants have found a way to generate crystals have 7 or more facets, which have a variety of uses as described in the present application.

Claims 1-3 and 5-6 stand rejected as anticipated and Claim 4 stands rejected as anticipated or obvious over Ruoff et al. Ruoff discloses the encapsulation of metals inside the polyhedron shells of carbon nanoencapsulates. As shown in the various figures of Ruoff and described in the specification, these nanoencapsulates are relatively ball or spheroid-like particles, much different from the elongated polyhedral crystals of the present invention. Further, since the nanoencapsulates of Ruoff are more polyhedron "balls", they do not have external facets that run substantially the length of the long axis. This is already acknowledged by the Examiner in the rejection, since the Examiner did not reject original Claim 7, drawn to the present crystals in the form of needles, whiskers, etc. Since claim 1, as now amended, has added the limitations of claim 7, the claim is now believed to be patentably distinguished from Ruoff, as are the remaining claims in the case. Accordingly the rejection should be withdrawn.

Claims 1, 7, 8, 10 and 16 stand rejected as anticipated or obvious in view of Araki et al. Araki et al disclose the preparation of graphite fibers by twisting carbon fibers at a

specified twisting rate, then graphitizing the twisted yarn. The fibers of Araki et al are significantly larger than the crystals of the present invention. As shown in Table 3 of Araki, the fibers have a diameter on the order of 8-9 microns. However, the crystals of the present invention are about 1 order of magnitude or more smaller, having a diameter of from 5-1000 nm. Again, the Examiner acknowledged this distinction in the Official Action by not rejection original claim 5, which contained the requirement for diameter of the crystals. Since the limitations of that claim have also been added to claim 1, the rejection is believed to be overcome and should be withdrawn.

Claims 1-7, 9-11, 15-16, 31-37, 39, 40-41, 45-47 and 49 stand rejected as anticipated or obvious over Liu et al. Liu discloses a study using nanodiffraction to study the structures of carbon nanotubes having diameters of a few nanometers. The Examiner has taken the position that Liu either discloses such nanotubes having 7 or more sides explicitly, or that they would be present, though not disclosed. However, Applicants note that none of the pictures provided in Liu disclose a 7 or more sided nanotube, nor is a method for producing such nanotubes disclosed. The method used by Liu is that of the high temperature arc discharge type. While the Examiners took the position during the discussion with Applicants representative that the diagram of Fig. 8 could be interpreted to have 10 sides, with each intersection of the long sides resulting in a very short side at the "point" of the pentagon. While Applicants do not agree with this interpretation of Fig. 8 of Liu, Applicants note that claim 1 and 31 now require that the 7 or more external facets be of substantially equal size. This type of crystal or nanotube is nowhere disclosed or suggested by Liu. As such, the rejection is believed to be overcome and should be withdrawn.

Applicants hereby affirm the election, with traverse, of Group I, claims 1-16, 27-28 and 31-49 for prosecution in this application. It is Applicants position that the Office has not carried the burden of showing patentable distinctness between the recited groups, nor that a

serious burden would be placed upon the Examiner if restriction were not required. The reasons given to try and distinguish the claims of the different groups are not believed to be sufficient to support patentable distinctness. However, in light of the Examiner's indication of allowable subject matter in the Office Action and during the discussion with Applicants' representative, Applicants have cancelled the non-elected claims in order to advance prosecution at the quickest pace.

Consequently, in light of the above discussion and in view of the present amendment, the present application is believed to be in condition for allowance and an early and favorable action to that effect is respectfully requested.

Respectfully submitted,

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A handwritten signature in black ink, appearing to read "J. Derek Mason", written over a horizontal line.

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